IN THE CLAIMS:

Please amend the claims as follows. No new matter has been added by way of these amendments.

[c1] (Original) A nuclear magnetic resonance instrument, comprising:

a housing adapted to move in a wellbore drilled through earth formations;

a magnet disposed in the housing adapted to induce a static magnetic field having a selected magnetic field strength in a zone of interest;

an antenna assembly disposed in the housing, the antenna assembly adapted to resonate at a first frequency and a second frequency, the first frequency corresponding to a resonance frequency of a first nucleus at the selected magnetic field strength, the second frequency corresponding to a resonance frequency of a second nucleus at the selected magnetic field strength, wherein the first nucleus is different from the second nucleus;

means for inducing a radio frequency magnetic field according to a selected pulse sequence in the zone of interest, the means for inducing the radio frequency magnetic field being operatively coupled to the antenna assembly; and

means for detecting nuclear magnetic resonance signals at the first frequency, the means for detecting being operatively coupled to the antenna assembly.

[c2] (Original) The instrument of claim 1, wherein the first nucleus is a proton.

[c3] (Original) The instrument of claim 1, wherein the second nucleus is carbon-13.

[c4] (Original) The instrument of claim 1, wherein the second nucleus is oxygen-17.

[c5] (Original) The instrument of claim 1, wherein the second nucleus is phosphorus-31.

[c6] (Original) The instrument of claim 1, wherein the zone of interest is in the earth formations surrounding the wellbore.

[c7] (Original) The instrument of claim 6, wherein the housing is adapted to be lowered into the wellbore on an electric cable.

[c8] (Original) The instrument of claim 6, wherein the housing forms part of a drilling tool assembly.

[c9] (Original) The instrument of claim 1, wherein the housing forms part of a formation fluid sampling tool and the zone of interest is inside the formation fluid sampling tool.

[c10] (Original) The instrument of claim 1, wherein the antenna assembly comprises an antenna coupled to a double resonance circuit.

[c11] (Original) The instrument of claim 1, wherein the antenna assembly comprises a first antenna and a second antenna.

[c12] (Original) The instrument of claim 10, wherein the first antenna and the second antenna are substantially orthogonal to each other.

[c13] (Original) The instrument of claim 10, wherein at least one of the first antenna and the second antenna comprises one selected from a saddle antenna and a loop antenna.

[c14] (Original) The instrument of claim 10, wherein the first antenna is selectively connected to a circuit adapted to transmit a radio frequency wave having the first frequency and the second antenna is selectively connected to a circuit adapted to transmit a radio frequency wave having the second frequency.

[c15] (Original) The instrument of claim 1, wherein the selected pulse sequence comprises a Carr-Purcell-Meiboom-Gill pulse sequence at the first frequency and an 180-degree pulse train at the second frequency.

[c16] (Original) A nuclear magnetic resonance instrument, comprising:

a housing adapted to move in a wellbore drilled through earth formations;

a magnet disposed in the housing adapted to induce a static magnetic field having a selected magnetic field strength in a zone of interest;

means for inducing a radio frequency magnetic field in the zone of interest at a first frequency, the first frequency being a resonance frequency of a first nucleus at the selected magnetic field strength;

means for inducing a radio frequency magnetic field in the zone of interest at a second frequency, the second frequency being a resonance frequency of a second nucleus at the selected magnetic field strength, wherein the first nucleus is different from the second nucleus; and

means for detecting nuclear magnetic resonance signals at the first frequency.

[c17] (Original) The instrument of claim 16, wherein the zone of interest is in the earth formations surrounding the wellbore.

[c18] (Original) The instrument of claim 16, wherein the housing forms part of a formation fluid sampling tool and the zone of interest is inside the formation fluid sampling tool.

[c19] (Original) A nuclear magnetic resonance instrument, comprising:

a housing adapted to move in a wellbore drilled through earth formations;

a magnet disposed in the housing adapted to induce a static magnetic field having a selected magnetic field strength in a zone of interest;

an antenna disposed in the housing, the antenna being adapted to resonate at a frequency corresponding to a resonance frequency of a nucleus at the selected magnetic field strength, wherein the nucleus is not a proton;

means for producing a polarization transfer pulse sequence and a Carr-Purcell-Meiboom-Gill pulse sequence, the means for producing being operatively coupled to the antenna; and

means for detecting nuclear magnetic resonance signals.

[c20] (Original) The instrument of claim 19, wherein the zone of interest is in the earth formations surrounding the wellbore.

[c21] (Original) The instrument of claim 19, wherein the housing is part of a formation fluid sampling tool and the zone of interest is inside the formation fluid sampling tool.

[c22] (Original) A method for determining a formation fluid property using a nuclear magnetic resonance instrument in a wellbore, comprising:

inducing a static magnetic field having a selected magnetic field strength in a formation fluid sample;

acquiring nuclear magnetic resonance measurements having J coupling information using the nuclear magnetic resonance instrument; and

deriving the J coupling information from the nuclear magnetic resonance measurements.

[c23] (Original) The method of claim 22, wherein the formation fluid sample comprises connate fluids withdrawn into a sample tube of the nuclear magnetic resonance instrument in a formation fluid sampling tool.

[c24] (Original) The method of claim 22, wherein the formation fluid sample comprises connate fluids in earth formations surrounding the wellbore.

[c25] (Original) The method of claim 22 wherein the acquiring comprises collecting nuclear magnetic resonance data using a pulse sequence that includes a Carr-Purcell-Meiboom-Gill pulse sequence.

[c26] (Original) The method of claim 22 wherein the acquiring comprises collecting nuclear magnetic resonance data using a pulse sequence that includes a phase-cycled Carr-Purcell-Meiboom-Gill pulse sequence.

[c27] (Original) The method of claim 22, wherein the J coupling comprises homonuclear J coupling.

[c28] (Original) The method of claim 22, wherein the J coupling comprises heteronuclear J coupling.

[c29] (Original) The method of claim 28, wherein the acquiring comprises

(a) applying an excitation pulse at a first frequency, the first frequency being a resonance frequency of a first nucleus at the selected magnetic field strength;

(b) waiting for a selected delay time;

(c) simultaneously applying a refocusing pulse at the first frequency and a inversion pulse at a second frequency, the second frequency being a resonance frequency of a second nucleus at the selected magnetic field strength, the first nucleus being different from the second nucleus;

(d) waiting for the selected delay time; and

(e) recording signals at the first frequency.

[c30] (Original) The method of claim 29~~22~~, wherein the recording lasts for a duration shorter than the selected delay time.

[c31] (Original) The method of claim 30~~23~~, further comprising:

repeating, for a predetermined number of times, (c) through (e) after a duration that substantially equals the selected delay time has elapsed since start of the recording

[c32] (Original) The method of 29~~22~~, wherein at least one of the excitation pulse, the refocusing pulse at the first frequency, and the inversion pulse at the second frequency comprises a composite pulse.

[c33] (Original) The method of claim 29~~22~~, wherein the acquiring comprises collecting nuclear magnetic resonance data using a reverse-detection pulse sequence.

[c34] (Original) The method of claim 33, wherein the reverse-detection pulse sequence further comprises a polarization transfer pulse sequence.

[c35] (Original) The method of claim 29~~22~~, wherein the acquiring comprises using a pulse sequence comprising one selected from an inversion-recovery pulse sequence and a saturation-recovery pulse sequence.

[c36] (Original) The method of claim 29~~22~~, wherein the deriving comprises separating a J coupling modulated part from an unmodulated part in the nuclear magnetic resonance measurements.

[c37] (Original) The method of claim 36, wherein the separating is performed with Fourier transformation.

[c38] (Original) The method of claim 29~~22~~, wherein the deriving comprises obtaining a difference measurement.

[c39] (Original) The method of claim 29~~22~~, further comprising estimating a formation fluid property from the J coupling information.

[c40] (Original) The method of claim 39, wherein the estimating further comprises using, in combination with the J coupling information, at least one parameter selected from a spin-lattice relaxation time, a spin-spin relaxation time, a ratio of spin-lattice relaxation time and spin-spin relaxation time, and a diffusion constant.

[c41] (Original) The method of claim 39, wherein the estimating further comprises using, in combination with the J coupling information, at least one parameter selected from compositional information, optical properties, mechanical properties, electrical properties, and nuclear magnetic resonance properties.

[c42] (Original) A method for estimating a volume fraction of oils in earth formation fluids, comprising:

acquiring nuclear magnetic resonance measurements having carbon-hydrogen J coupling information;

separating a J coupling modulated part from an unmodulated part in the nuclear magnetic resonance measurements; and

determining the volume fraction of oils in the earth formation fluids by comparing a total magnitude of the J coupling modulated part to a total magnitude of the nuclear magnetic resonance measurements.